From: Robert Siegfried [mailto:rsiegfried@valleywater.org]
Sent: Friday, September 02, 2011 4:27 PM
To: Agriculture Water Use Efficiency
Cc: Jemaa, Fethi Ben
Subject: estimation of ETc

The difference between estimating crop irrigation requirements and estimating crop evapotranspiration may benefit from clarification.

The two-step ET_o X K_c method, with ET_o estimated by CIMIS or SpatialCIMIS, is well established for estimation of crop irrigation requirements. However, the method serves better for estimating irrigation requirements than it does for estimating crop evapotranspiration. Irrigation requirements differ from crop evapotranspiration. Crop evapotranspiration varies across a field as a function of many variables, principal among which are crop development and soil water potential, neither of which are uniformly distributed either spatially or temporally.

Two important assumptions are implicit in the two step method:

Crop development is uniform across a field.

Crop development curves have generally been modeled as a function of time rather than as a function of growing degree days or of ET_o.

Soil hydraulic conductivity is the most highly variable of soil parameters, and consequently variations in soil water availability result in variation in plant evapotranspiration. Few Kc curves are referenced to ETo, although some recent research has made this reference for alfalfa. The length of season for a crop differs between regions, but crop development curves do not, and likely will not, exist for all regions. FAO 56 contains adjustments for several growing conditions, but these are not exhaustive. Errors induced by these assumptions are not critical for irrigation scheduling, for irrigation must respond to the driest part of a field and not to the field average, assuming reasonable irrigation uniformity. Competent practitioners of CIMIS-based irrigation scheduling will anyway incorporate management coefficients into calculations.

Accurate estimation of crop evapotranspiration should capture variation caused by differences in plant development, irrigation system non-uniformity and soil hydraulic properties. Any estimate of evapotranspiration will smooth this variation to some extent, but it is suggested that satellite-based methods that provide estimates on a pixel-by-pixel basis, an approximately 30 meter square grid, will more accurately reflect actual crop evapotranspiration than will methods which *a priori* assume uniform crop development and uniform growing conditions.

METRIC is one such method. It makes use of existing weather station networks, e.g. CIMIS, for calibration of thermal band intensities to measured ETo. It is currently configured for use with alfalfa, but reconfiguring for turf seems feasible. The additional advantage of universally accessible data coupled with well defined methods provides transparency to interested groups.

Regards,

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